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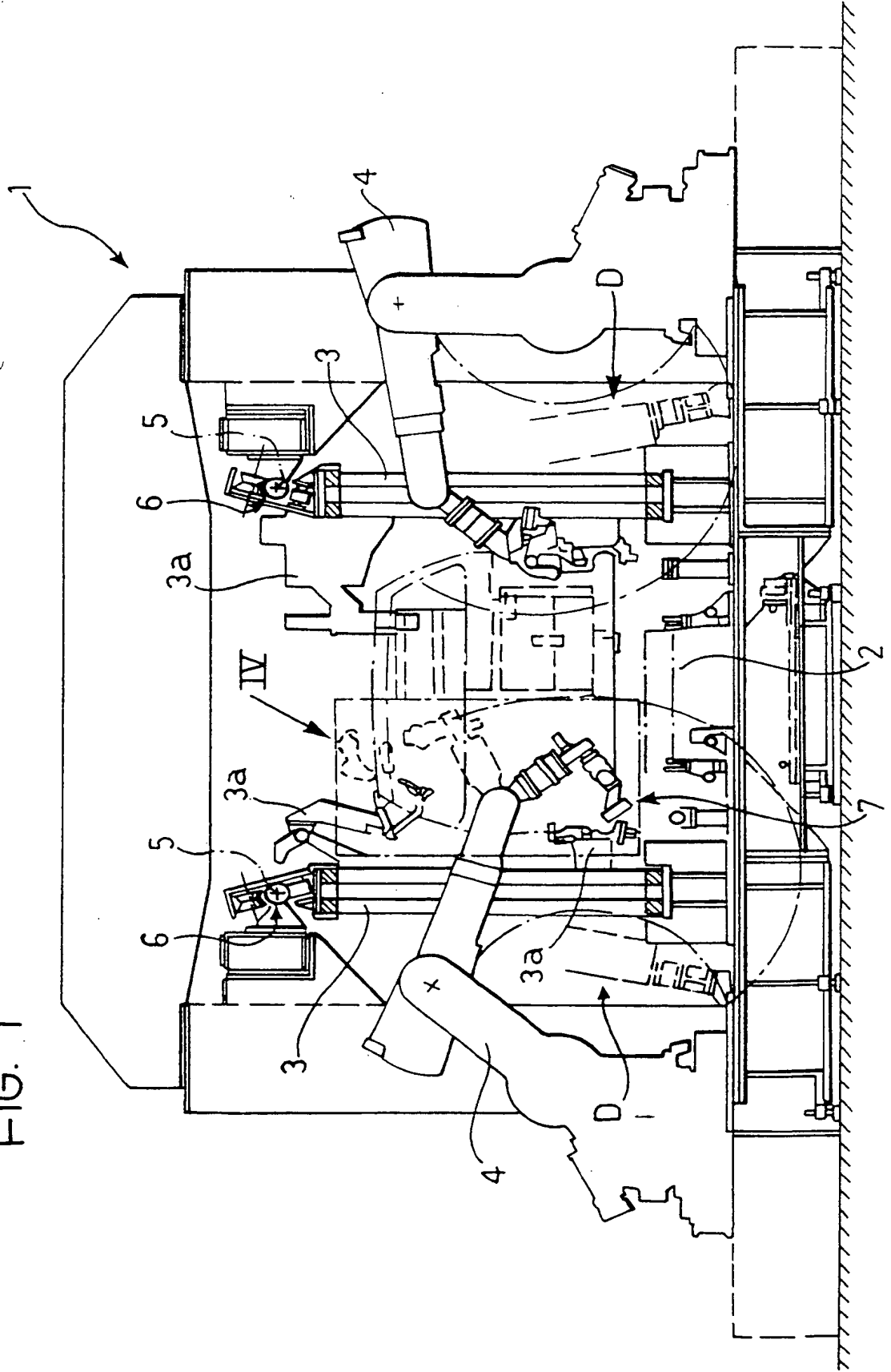
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(54) **A station for assembling pressed sheet-metal structure with welding robots also usable periodically for checking the fixtures used in the station.**

(57) **A station for assembling pressed sheet-metal structures, for example, motor-vehicle bodies, includes fixtures (3a) for locating and clamping the various components of the structure in the assembled condition and programmable robots (4) with electrical spot-welding heads. One or more robots (4) have means for replacing their welding heads with sensor (7) for checking the positioning and/or configuration of the locating and clamping fixtures (3a) to ensure the quality of the product output from the station.**

**EP 0 464 004 A1**

FIG. 1





European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number

EP 91 83 0253

| DOCUMENTS CONSIDERED TO BE RELEVANT  |   |   |   |
|--|---|---|---|
| Category   | Citation of document with indication, where appropriate, of relevant passages   | Relevant to claim                                   | CLASSIFICATION OF THE APPLICATION (Int. CL.5) |
| Y  | PATENT ABSTRACTS OF JAPAN<br>vol. 9, no. 213 (M-408)(1936) August 30, 1985<br>& JP-A-60 72 692 (TOSHIBA K.K. ) April 24, 1985<br>* the whole document *   | 1   | B23K37/04                                     |
| Y  | FR-A-2 465 553 (NISSAN MOTOR COMPANY, LIMITED)<br>* page 12, line 18 - page 13, line 23 *<br>* page 17, line 7 - line 32 *<br>* page 19, line 34 - page 20, line 9 *<br>* page 22, line 13 - page 24, line 36 *<br>* page 28, line 30 - page 29, line 26; figures 1-3 * | 1   |   |
| A  | EP-A-147 530 (THYSSEN MASCHINENBAU GMBH)<br>* the whole document *  | 1   |   |
| A  | WO-A-8 602 307 (PLESSEY OVERSEAS LIMITED)<br>* the whole document *   | 1,2   |   |
|  |   |   | TECHNICAL FIELDS SEARCHED (Int. CL.5)         |
|  |   |   | B23K<br>B62D<br>B25J                          |
| The present search report has been drawn up for all claims   |   |   |   |
| Place of search<br>THE HAGUE   |   | Date of completion of the search<br>04 OCTOBER 1991 | Examiner<br>ARAN D.D.                         |
| <p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone<br/>Y : particularly relevant if combined with another document of the same category<br/>A : technological background<br/>O : non-written disclosure<br/>P : intermediate document</p> <p>T : theory or principle underlying the invention<br/>E : earlier patent document, but published on, or after the filing date<br/>D : document cited in the application<br/>L : document cited for other reasons<br/>* : member of the same patent family, corresponding document</p> |   |   |   |

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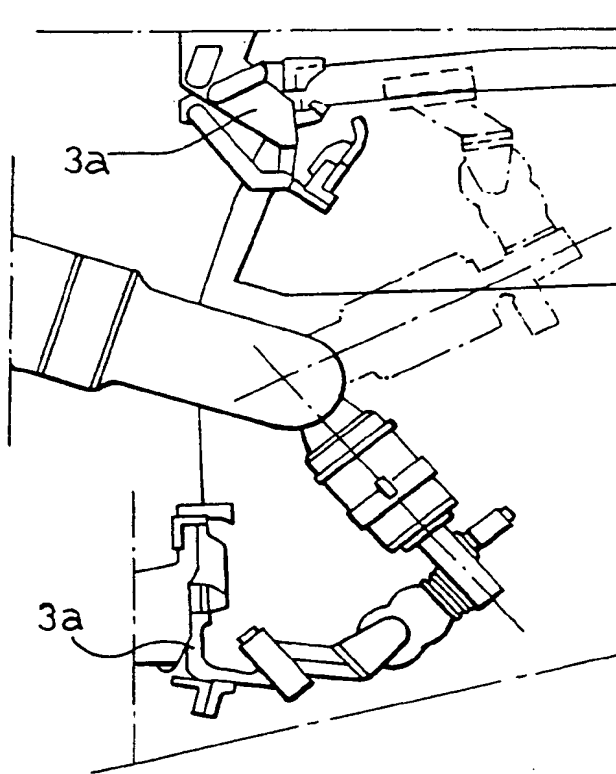


FIG. 3

FIG. 4

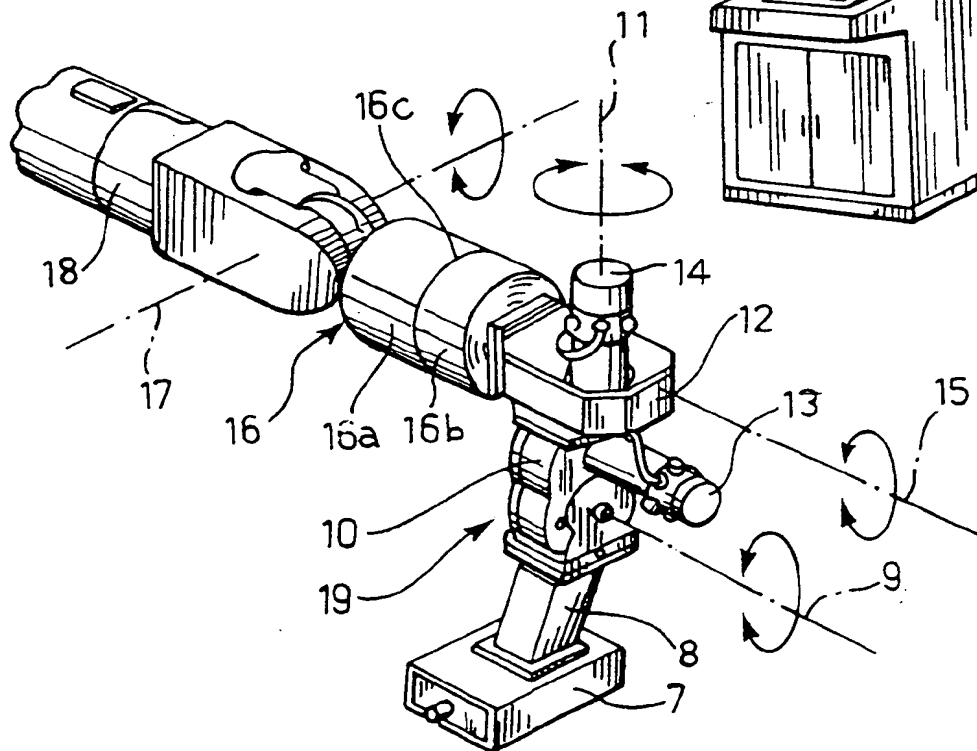
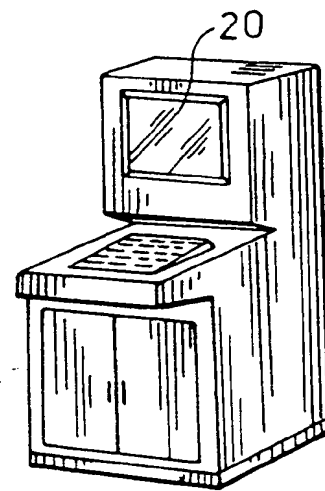
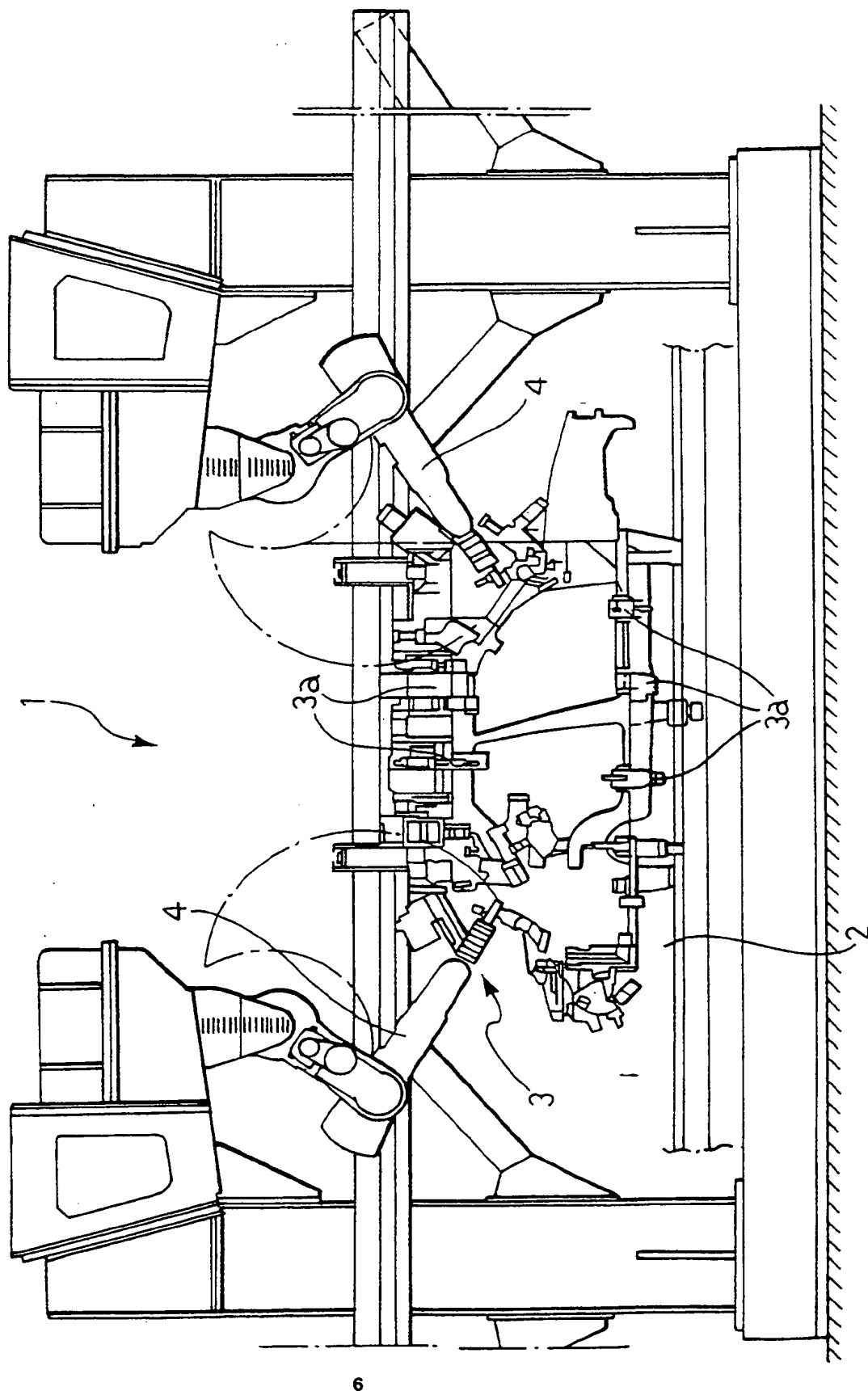
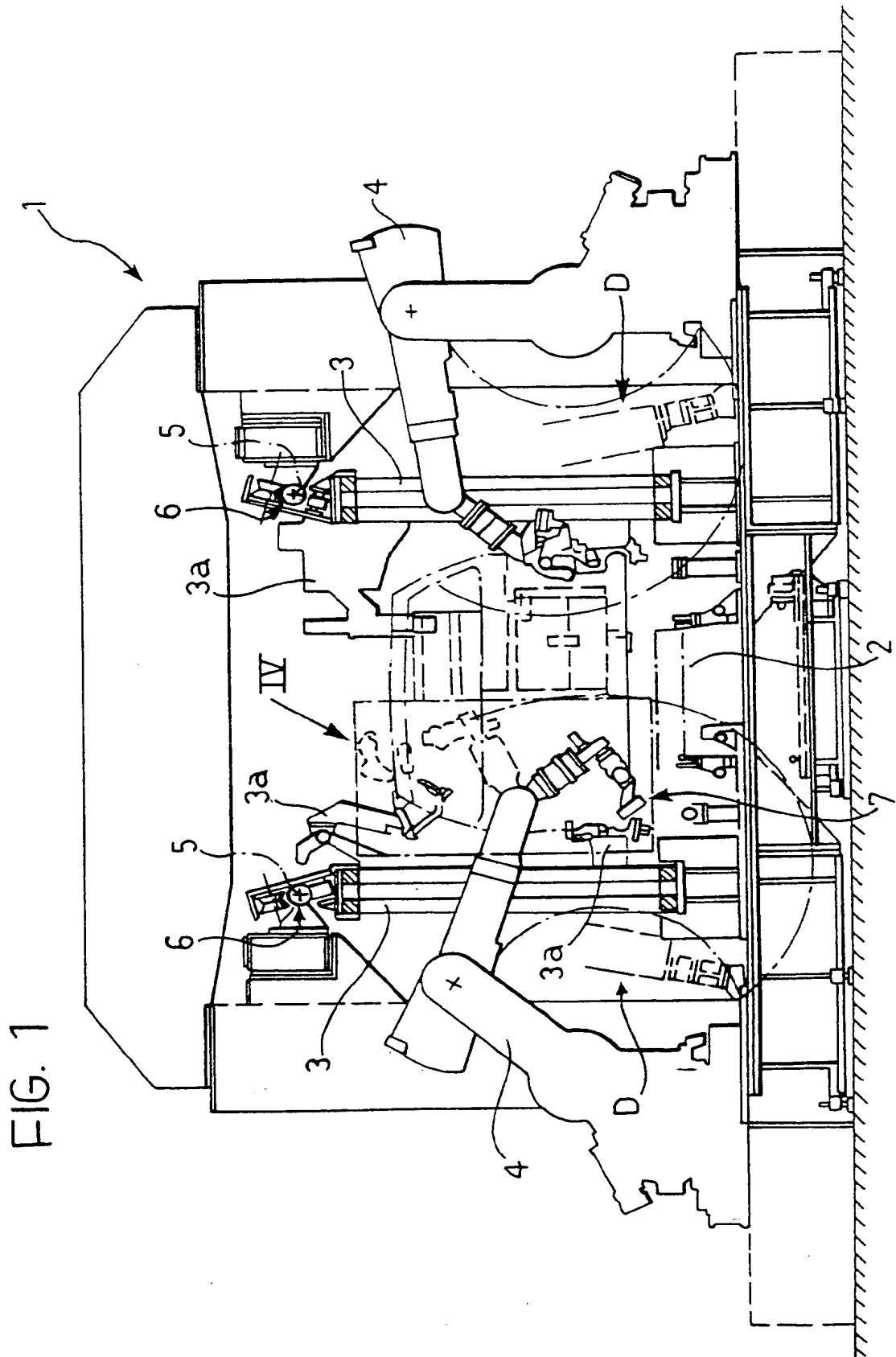


FIG. 2





rotatable about an axis 9 relative to an auxiliary support structure 10 which is in turn rotatable relative to a further structure 12 about an axis 11 perpendicular to the axis 10. The electric motors for rotating the arm 8 and the auxiliary structure 10 are indicated 13, 14 respectively. The structure 12 in turn is mounted for rotation about an axis 15 parallel to the axis 9 on a support device 16 articulated to the wrist 18 of the robot about an axis 17. The structure 16 has a part 16a which is connected permanently to the robot's wrist and a part 16b which is connected releasably to the part 16a. The structural details of the means used for this connection are of known type and do not fall within the scope of the present invention. For this reason, these details have been omitted from the appended drawings which also makes the latter simpler and easier to understand. In practice, the structure 16 can be produced according to the prior art relating to robots with devices for exchanging their tools. According to this prior art, a robot can replace its own tool.

In the case of the present invention, the robot 4 can disengage the welding head at the surface 16c where it is connected to the part 16a and then equip itself with the entire adjustable structure, indicated 19 in the drawing, which carries the television camera 7. The television camera is connected to means for processing its output signals including, for example, a display terminal 20.

Periodically, one or more robots replace their welding heads with orientable television cameras 7 and bring the television cameras into correspondence with the fixtures 3a (see Figure 4 which is a magnified view of the detail IV of Figure 1) so that the configuration and/or positioning of the fixtures can be checked. Thus, if it detects that the fixtures are displaced from their correct positions, action can be taken immediately to correct the displacement. The checking operation does not involve any wastage of time by skilled personnel or difficulties resulting from difficult access to the fixtures for the personnel.

At the same time, the checks are carried out with the use of the same robots which are provided at the station for welding the body.

Naturally, the principle of the invention remaining the same, the details of construction and forms of embodiment may be varied widely with respect to those described and illustrated purely by way of example, without thereby departing from the scope of the present invention.

assembled condition and programmable robots (4) with electrical spot-welding heads, characterised in that at least one of the programmable robots (4) has means for replacing its welding head with a sensor (7) for checking the positioning and/or configuration of the fixtures.

2. An assembly station according to Claim 1, characterised in that the sensor is constituted by an orientable television camera (7) connected to means (20) for processing its output signals.
3. An assembly station according to Claim 2, characterised in that the television camera (7) is carried by an arm (8) mounted for rotation about an axis (9) on an auxiliary support structure (10) which is in turn mounted on a further structure (12) for rotation about an axis (11) perpendicular to the axis (9), the further structure (12) being mounted for rotation about an axis (15) parallel to the articulation axis (9) of the arm (8) relative to a further support structure (16b) releasably connected to the wrist (18) of the robot.

## Claims

1. A station for assembling pressed sheet-metal structures, for example, motor-vehicle bodies, including fixtures (3a) for locating and clamping the various components of the structures in the

The present invention relates to a station for assembling pressed sheet-metal structures, for example, motor-vehicle bodies, including fixtures for locating and clamping the various components of the structure in the assembled condition and programmable robots with electrical spot-welding heads.

Assembly stations of the type indicated above have been produced and sold by the Applicant for some time. The locating and clamping fixtures with which the assembly stations are provided - whose positions are adjustable - define the correct positions of the components of the structure during welding. The displacement of one or more fixtures from their correct positions results in the production of defective products. For example, in the case of a motor-vehicle body, the displacement of one or more locating fixtures from their correct positions may result in a body being output from the station with parts which are deformed from their intended configurations.

Currently, when a situation of the type described above occurs, the production line has to be stopped and one or more operators must intervene to check the correct positioning of all the fixtures of the welding station until they identify the wrongly-positioned fixture or fixtures and take action to eliminate the error. This operation is lengthy and is also laborious because it may be difficult for the operator to gain access to the various fixtures.

In order to prevent the aforesaid problems, the subject of the present invention is an assembly station of the type indicated above, characterised in that at least one of the programmable robots in the assembly station has means for replacing its welding head with a sensor for checking the positioning and/or configuration of the fixtures.

In a preferred embodiment, the sensor is constituted by an orientable television camera connected to means for processing its output signals.

Thus, the assembly station according to the invention can itself carry out automatically the periodic checks and controls which ensure the quality of the product by means of its robots.

Further characteristics and advantages of the invention will become clear from the description which follows with reference to the appended drawings provided purely by way of non-limiting example, in which:

Figure 1 is a cross-section of a station according to the invention for welding motor-vehicle bodies, Figure 2 is a side view of the station of Figure 1, Figure 3 is a perspective view of a detail of the station of the invention on an enlarged scale, and Figure 4 shows a further detail of the station according to the invention.

With reference to Figures 1 and 2, a station formed according to the invention for welding motor-vehicle bodies is indicated 1.

For example, the station may be of the type described and illustrated in the present Applicant's Ger-

man patent No. 2 810 822.

The structural details of the station do not fall within the scope of the present invention and may be in accordance with the prior art. For this reason, they will be described only briefly below.

A conveyor line 2 passes through the station 1 and transports a plurality of bodies to be welded through the station in succession. The bodies arrive in the station in a preassembled condition in which their components have been connected loosely, for example, by the bending of sheet-metal tabs which interconnect the components. For this reason, the body components have to be clamped in their exact positions of assembly during welding. For this purpose, two frames 3 are provided on the two sides of the line 2 in the welding station 1 and carry a plurality of clamping fixtures 3a (some of which are visible in the drawings) including locating elements and clamps which engage the various components of the body when it is in the working position in the welding station 1 in order to keep them in the correct positions of assembly during welding. The welding is carried out by a plurality of programmable robots 4 with welding heads (not shown) which perform a series of spot-welds which suffice to fix the geometry of the body. Once the welding has been carried out, the locating and clamping fixtures are released from the body and the body is discharged from the station, enabling a subsequent body to enter the station for welding. The two frames 3 which carry the locating and clamping fixtures 3a are pivotable about respective upper longitudinal axes 5 between substantially vertical positions (shown in continuous outline in Figure 1) in which the fixtures 3a can engage the body, and positions (shown in broken outline and indicated by the arrows D) in which they are opened out and the fixtures 3a are spaced from the body so that the welded body can leave the station and a new body can enter the station for welding. Still according to the prior art cited above, the two frames 3 are also slidable along upper longitudinal guides 6 so that they can be exchanged rapidly with a second pair of frames 3 (not visible in the drawings) adapted for working on a different type of body. The same welding station can thus work on various body types. As already indicated above, all the characteristics described above are known from the Applicant's prior patent mentioned above. Further details concerning the construction and advantages of this arrangement can therefore be obtained directly from that patent.

The main characteristic of the station of the present invention consists of the fact that at least some of the welding robots have means for enabling their normal electrical spot-welding heads to be replaced by sensors which, in the embodiment illustrated, are constituted by orientable television cameras 7. With reference in particular to Figure 3, each orientable television camera 7 is carried by an arm 8 which is